REMARKS

This application has been carefully reviewed in light of the Office Action dated November 22, 2000. Claims 1 to 4, 6, 7, 9 to 33, 35, 36, 38 to 62, 64, 65 and 67 to 93 remain in the application, of which Claims 19 to 93 have been withdrawn from further consideration pursuant to a restriction requirement. Of the claims currently under consideration, Claims 1, 4, 7 and 10 are independent and Claims 1, 4, 6 and 9 have been amended. Claims 30, 33, 35, 38, 59, 62, 64, 67, 88 and 89 have also been amended for consistency with their corresponding claims that are currently under consideration in order to place them in better condition for allowance in the event that the restriction requirement is withdrawn. Reconsideration and further examination are respectfully requested.

Claim 9 was rejected under 35 U.S.C. § 112, second paragraph. Claim 9 has been amended for dependency only for consistency with the prior cancellation of Claim 8. Additionally, although Claims 38 and 67 have been withdrawn from further consideration, they have also been amended for consistency with the prior cancellation of Claims 37 and 66, respectively. Withdrawal of the § 112 rejection is respectfully requested.

Likewise, Claims 6, 36 and 64 have been amended for dependency only for consistency with the cancellation of Claims 5, 35 and 63, respectively.

Claims 1 to 3, 7 and 10 to 18 were rejected under 35 U.S.C. § 103(a) over U.S. Patent 5,543,826 (Kuronuma) in view of U.S. Patent 5,406,317 (Shimamura), and Claims 4 to 6 and 9 were rejected under § 103(a) over U.S. Patent 5,552,811 (Kurata) in view of U.S. Patent 5,729,257 (Sekiya). Reconsideration and withdrawal of the rejections are respectfully requested.

The present invention concerns cooling of a print head and capping the print head only after the print head has sufficiently cooled. According to the invention, the print head is cooled, possibly by ejecting ink droplets from the print head, and only after the print head has cooled to a threshold temperature is the print head capped. As a result, the print head is not capped while hot ink remains in the print head nozzles and flow passages, thereby providing for a better ink meniscus to form in the print head.

Specifically, amended independent Claim 1 is a method of controlling a print operation of an ink jet printer, comprising the steps of determining whether a print head temperature has cooled to a threshold temperature after a printing operation, and controlling a capping sequence to

cap the print head after the print head temperature has cooled to the threshold temperature.

The applied art is not seen to disclose or to suggest the features of Claim 1. In particular, the applied art is not seen to disclose or to suggest determining whether a print head temperature has cooled to a threshold temperature after a printing operation, and controlling a capping sequence to cap the print head after the print head temperature has cooled to the threshold temperature.

Kuronuma discloses a warming-up and recovery process for an ink jet printer that is performed upon initial power-up of the printer. The process is shown in each of Figures 10, 12 and 17, with each Figure providing slight variations from the others. In sum, when the printer is powered on S101, a determination is made whether the cap is open or closed S103, and if the cap is open, it is closed in step S106. Once the cap is closed, the print head is heated to a temperature of at least 30°C or 45°C (steps S104 to S109 and S107 to S110) so that ink that has dried up in the nozzles can be easily sucked out by a suction device. Once the print head is sufficiently heated, a recovery process is performed S111 to suck the ink from the print head nozzles. After the recovery process is performed, the cap is opened S112 and if print data is received, a recording operation

commences. If print data is not received within a specified count S114 to S117, the cap is closed S118.

As can readily be seen from the foregoing, Kuronuma does not detect whether a print head has been cooled, but rather detects whether the print head has been sufficiently heated. Additionally, Kuronuma only caps the print head after an elapsed period of time (when the count = 5) and there is no relation between the print head temperature and the capping operation. Accordingly, Kuronuma does not disclose or suggest the features of Claim 1.

Shimamura does not add anything to overcome the foregoing deficiencies of Kuronuma. In this regard, Shimamura discloses an ink recovery process whereby, when printing in started, a preliminary ejection is performed to eject dried up ink from the print head. The ink ejected during the preliminary ejection process is ejected into an absorbing member 501 in a cap 51. After a predetermined number n1 of preliminary ejection operations have been performed, a dry absorption process is carried out whereby the cap is opened and a pump sucks ink retained in the absorbing member and the cap through an orifice.

Shimamura does not detect a print head temperature at all and more particularly, does not detect whether the print head has cooled to a threshold temperature. Additionally, Shimamura caps its print head either to perform

the recovery process or at the end of printing a page, without regard to whether the print head has sufficiently cooled. Accordingly, Shimuamura does not disclose or suggest the features of Claim 1.

Therefore, independent Claim 1 is believed to be allowable over the applied art.

Independent Claim 7 is a method of controlling a print operation of an ink jet printer, comprising the steps of printing an image using a print head, and cooling the print head by causing ink droplets to be ejected from the print head after the end of the printing operation.

Neither Kuronuma or Shimamura disclose or suggest cooling a print head by ejecting ink droplets after the end of a printing operation. In this regard, as stated above, Kuronuma performs a recover operation by warming a print head and sucking ink from the nozzles. Nowhere does Kuronuma disclose that the print head is cooled by ejecting ink droplets. Shimamura, while performing a recovery process by ejecting ink, the recovery process is a preliminary ejection (i.e., a process performed prior to printing or commensurate with printing after a predetermined amount of time has elapsed). Nowhere does Shimamura disclose or suggest that the print head is cooled after the printing operation by ejecting ink droplets from the print head.

Accordingly, independent Claim 7 is believed to be allowable over the applied art.

Independent Claim 10 is a method of controlling a print operation of an ink jet printer, comprising the steps of obtaining a parameter corresponding to a print head temperature when the ink jet printer is down in order to determine whether a print head cooling operation has been interrupted, and performing a predetermined process based on the parameter.

Neither Kuronuma or Shimamura disclose or suggest the features of Claim 10. Again, Kuronuma discloses a warming-up process where the print head is heated and the temperature of the print head is detected to determine whether the print head has been sufficiently heated to perform efficient sucking of ink from the nozzles. Kuronuma does not disclose or suggest that the print head temperature is detected to determine whether a print head cooling operation has been interrupted.

Shimamura does not detect the print head temperature at all and therefore does not disclose or suggest that the print head temperature is detected to determine whether a print head cooling operation has been interrupted.

Accordingly, Claim 10 is also believed to be allowable over the applied art.

Amended independent Claim 4 is a method of

controlling a print operation of an ink jet printer, comprising the steps of cooling a print head by causing ink droplets to be ejected from the print head, and capping the print head after the print head is cooled.

The applied art is not seen to disclose or suggest the features of Claim 4. In particular, the applied art is not seen to disclose or to suggest at least the feature of cooling a print head by causing ink droplets to be ejected from the print head and thereafter capping the print head.

Kurata discloses a print head recovery and cleaning process. Prior to commencing a print operation, the print head is heated to perform a preliminary ejection of ink. Additionally, a rinsing liquid and an air stream are utilized to clean the print head and a capping device. Then, printing commences. After printing is completed, the print head is wiped clean and then capped. Therefore, Kurata does not disclose or suggest that the print head is cooled by ejecting ink droplets from the print head and thereafter capping the print head. Rather, Kurata is like Shimamura in that it performs a preliminary ejection but not a post printing ejection for cooling the print head.

Sekiya is not seen to add anything to overcome the foregoing deficiencies of Kurata. Sekiya is seen to disclose a method for controlling the size of an ink droplet ejected onto a recording medium by changing the frequency and number

of ink droplets ejected for each pixel. However, nowhere is Sekiya seen to disclose or to suggest that the print head is cooled by ejecting ink droplets from the print head and thereafter capping the print head.

Accordingly, Claim 4 is believed to be allowable over the applied art.

Although Kuronuma and Shimamura were not applied against Claim 4, neither of these references are seen to add anything that would overcome the deficiencies of Kurata and Sekiya. Likewise, although Kurata and Sekiya were not applied against Claims 1, 7 and 10, they are not seen to add anything that would overcome the deficiencies of Kuronuma and Shimamura.

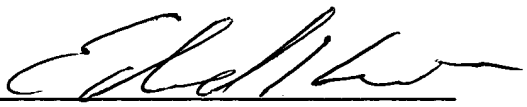
As a formal matter, although Claims 19 to 93 have been withdrawn from consideration, some of these claims have been amended herein for consistency with their corresponding method claims in order to place them in better condition for allowance should an action on the merits for these claims be issued in a next or subsequent Office Action.

In view of the foregoing amendments and remarks, the entire application is believed to be in condition for allowance and such action is respectfully requested at the Examiner's earliest convenience.

Applicants' undersigned attorney may be reached in our Costa Mesa, California office by telephone at (714) 540-

8700. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO CLAIMS

1. (Amended) A method of controlling a print operation of an ink jet printer, comprising the steps of:

determining whether a print head temperature has cooled to a threshold temperature after a printing operation; and

controlling a capping sequence to cap the print head after the [based on the determined] print head temperature has cooled to the threshold temperature.

4. (Amended) A method of controlling a print operation of an ink jet printer, comprising the steps of:

cooling a print head by causing ink droplets to be ejected from the print head [using a predetermined method]; and

capping the print head after the print head is cooled.

5. (Canceled)

6. (Amended) A method according to Claim 4 [5], wherein the ink droplets are ejected at a frequency lower than a frequency used for printing.

9. (Amended) A method according to Claim 7 [8], wherein the ink droplets are ejected at a frequency lower than a frequency used for printing.

30. (Amended) An apparatus for controlling a print operation of an ink jet printer, comprising:

a memory including a region for storing executable process steps;

a processor for executing the executable process steps; and

an interface between the processor and a print head of the ink jet printer that allows the processor to control firing of nozzles of the print head,

wherein the executable process steps include the steps of: (a) determining whether a print head temperature has cooled to a threshold temperature after a printing operation; and (b) controlling a capping sequence to cap the print head after the [based on the determined] print head temperature has cooled to the threshold temperature.

33. (Amended) An apparatus for controlling a print operation of an ink jet printer, comprising:

a memory including a region for storing executable

process steps;

a processor for executing the executable process steps; and

an interface between the processor and a print head of the ink jet printer that allows the processor to control firing of nozzles of the print head,

wherein the executable process steps include the steps of: (a) cooling a print head by causing ink droplets to be ejected from the print head [using a predetermined method]; and (b) capping the print head after the print head is cooled.

34. (Canceled)

35. (Amended) An apparatus according to Claim 33 [34], wherein the ink droplets are ejected at a frequency lower than a frequency used for printing.

38. (Amended) An apparatus according to Claim 36 [37], wherein the ink droplets are ejected at a frequency lower than a frequency used for printing.

59. (Amended) Computer-executable process steps stored on a computer-readable medium, the computer executable process

steps to control a print operation of an ink jet printer, the computer-executable process steps comprising:

code to determine whether a print head temperature has cooled to a threshold temperature after a printing operation; and

code to control a capping sequence to cap the print head after the [based on the determined] print head temperature has cooled to the threshold temperature.

62. (Amended) Computer-executable process steps stored on a computer-readable medium, the computer executable process steps to control a print operation of an ink jet printer, the computer-executable process steps comprising:

code to cool a print head by causing ink droplets to be ejected from the print head [using a predetermined method]; and

code to cap the print head after the print head is cooled.

63. (Canceled)

64. (Amended) Computer-executable process steps according to Claim 62 [63], wherein the ink droplets are ejected at a frequency lower than a frequency used for printing.

67. (Amended) Computer-executable process steps according to Claim 65 [66], wherein the ink droplets are ejected at a frequency lower than a frequency used for printing.

88. (Amended) A computer-readable medium which stores computer-executable process steps, the computer-executable process steps to control a print operation of an ink jet printer, the computer-executable process steps comprising:

a determining step to determine whether a print head temperature has cooled to a threshold temperature after a printing operation; and

a controlling step to control a capping sequence to cap the print head after the [based on the determined] print head temperature has cooled to the threshold temperature.

89. (Amended) A computer-readable medium which stores computer-executable process steps, the computer-executable process steps to control a print operation of an ink jet printer, the computer-executable process steps comprising:

a cooling step to cool a print head by causing ink droplets to be ejected from the print head [using a predetermined method]; and

a capping step to cap the print head after the print head is cooled.

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